EVALUATION OF POTENTIAL APPLICATIONS OF INTELLIGENT TRANSPORTATION SYSTEMS TECHNOLOGY AT ARCHES NATIONAL PARK

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Photo credit: National Park Service

INTRODUCTION

The planning process for a comprehensive transportation plan for Arches National Park has identified a variety of transportation issues. In conjunction with Park Service staff, the transportation plan consultant (OTAK) and an ITS subcontractor (LTK), these transportation issues were reviewed. Based on those discussions, three applications of Intelligent Transportation Systems (ITS) technology were identified as having potential for Arches National Park. The transportation issues and the ITS applications were:

1. Parking demand at many parking areas in the Park frequently exceeds capacity. There is the potential to monitor the number of occupied spaces in individual parking areas using vehicle detector technology. Information on crowded parking areas could then be disseminated to Park visitors at the Park entrance station, the visitor center, and at roadside locations within the Park.

2. Congestion at the Park entrance station has been a significant problem in recent years. Although the opening of a new two-lane entrance station and the relocation of the entrance road have alleviated the problem, there may continue to be congestion and undesirable waiting times during peak periods. This condition will grow as annual Park visitation grows. An automated system to process selected vehicles holds the promise of both reducing congestion and reducing the Park staffing required for the entrance station.

3. Advanced Traveler Information Systems provide an opportunity for Park visitors to better plan their trips to Arches. A summer, 2003 Visitor Study found that 31 percent of Park visitors obtained information from either the National Park Service website or the Arches National Park website prior to their visit. The Internet, and other forms of ITS technology, have the potential to provide a wealth of information to travelers that will assist them in trip planning.

The following sections of this report provide an extensive analysis of each of the above applications and present recommendations.

ITS APPLICATION TO PARKING AREAS

Analysis of the Parking Problem

The Alternatives Development Package dated February 2004 for the Arches National Park Transportation Plan identifies 20 major parking areas, as shown in Table 1.

TABLE 1 - MAJOR PARKING AREAS

PARKING AREA	TOTAL NUMBER OF SPACES
Visitor Center Parking Lot	138 *
Park Avenue Viewpoint Parking Area	26
La Sal Mountains Viewpoint Parking Area	10 (25)**
Courthouse Towers Viewpoint Parking Area	22
Tower of Babel Parking Area	2
Unsigned Courthouse Wash Parking Area	6
Petrified Dunes Viewpoint Parking Area	4
Balanced Rock Parking Area	20
Garden of Eden Parking Area	20
Double Arch Parking Area	24
Windows Parking Area	25
Panorama Point Parking Area	20 (43)**
Wolfe Ranch / Delicate Arch Trailhead Parking Area	77 (66)***
Delicate Arch Viewpoint Parking Area	63
Salt Valley Overlook Parking Area	8
Fiery Furnace Viewpoint Parking Area	17
Sand Dune Arch / Broken Arch Parking Area	20
Skyline Arch Trailhead Parking Area	7
Devils Garden Picnic Parking Area	15
Devils Garden Parking Area	106
TOTAL	657

* 138 spaces is the size of the new Visitor Center Parking Lot, currently under construction

** The author counted a larger number of parking spaces at two parking lots - approximately 25 spaces at the La Sal Mountains Viewpoint and approximately 43 spaces at Panorama Point. At both locations parking spaces are not marked.

*** 66 is a more realistic count at the Delicate Arch Trailhead. With the orientation of oversized spaces, they can be used by only one passenger car.

Park staff believe that many of the Park's parking areas have crowding problems. In particular, staff mentioned the Devils Garden Parking Area, the Wolfe Ranch / Delicate

Arch Trailhead Parking Area, and the Windows / Double Arch Parking Areas as parking areas that are most commonly a problem. When any parking area becomes full, or close to full, visitors are tempted to park in "unofficial" locations, such as wide spots on the shoulder. Parking in these "social pullouts" often results in resource damage. Signing and fencing are used to discourage parking in "unofficial" locations (see photo).

As a part of the transportation planning effort, parking occupancy data was collected at four parking areas on five days in the spring of 2003 (Tuesday, April 29 through Saturday, May 3) and five days in August of 2003 (Tuesday, August 5 through Saturday, August 9). Occupancy was noted from 9:00 a.m. to 6:00 p.m. However, for a given parking area data was collected for only about half a day on a given day and data was collected once per hour. For example, Devils Garden Parking Area data on May 2, 2003 are for 9:00, 10:00, 11:00, 12:00 and 1:00.

The four parking areas were:

- Visitor Center Parking Lot
- Windows / Double Arch Parking Areas
- Wolfe Ranch / Delicate Arch Trailhead Parking Area
- Devils Garden Parking Area

The Visitor Center Parking Lot, which at that time had only 46 spaces, did not experience any crowding during the data collection periods. The highest number of vehicles observed in the spring was 30 and the highest number observed in August was 35. Given that this parking lot is being enlarged to 138 parking spaces, it is unlikely that this lot will experience crowding in the future. Future parking duration may be longer due to the increased size of the visitor center (more exhibits and activities to see), but longer visitor stops alone are unlikely to cause crowding. However, if this parking lot is used as a staging area for future shuttle or transit service into the Park, that could create crowded conditions.

For purposes of this analysis, crowding is defined as a condition in which more than 85 percent of the spaces are occupied. At this level some vehicles may have difficulty finding parking spaces. In addition, it should also be realized that when occupancy was

noted once per hour, higher peaks in demand that occurred sometime during the intervening 60 minutes may not have been detected.

The Windows / Double Arch Parking Areas experienced crowding for several hours during the data collection periods. These areas have a total of 41 parking spaces. In the spring, there were three observed hours when more than 85 percent of the spaces were occupied. The highest observed number of vehicles was 38. In August, there were 12 observed hours when more than 85 percent of the spaces were filled. In fact, there were six hours for which the number of vehicles exceeded the number of parking spaces. The highest observed number of vehicles was 48.

The Delicate Arch Trailhead Parking Area has a total of 66 spaces. On Saturday, May 3, 2003 there were four hours when more than 85 percent of the spaces were filled, and two hours when 72 and 69 vehicles were counted. In August of 2003 the highest number of observed vehicles was 53.

At the Devils Garden Parking Area, the capacity is about 106 to 111 spaces. There were two hours in the spring of 2003 when more than 85 percent of the spaces were filled. In August, 2003 the highest observed number of vehicles was 89.

The above survey shows the parking conditions that existed on the 10 days that parking occupancy was observed. Because the survey dates were not on the days of highest Park visitation in 2003, the observations about crowding are only a general indicator of the parking congestion problem.

To obtain a better grasp of the seriousness of the parking problem, data on Park visitation for every day in 2003 was analyzed. The Park provided data on the number of vehicles passing through the entrance station on each day during the year. That data is shown in Figure 1. Fluctuations in visitation from season to season, for holiday periods, and for weekends are obvious.

FIGURE 1 - NUMBER OF VEHICLES ENTERING ARCHES NATIONAL PARK BY DAY - 2003

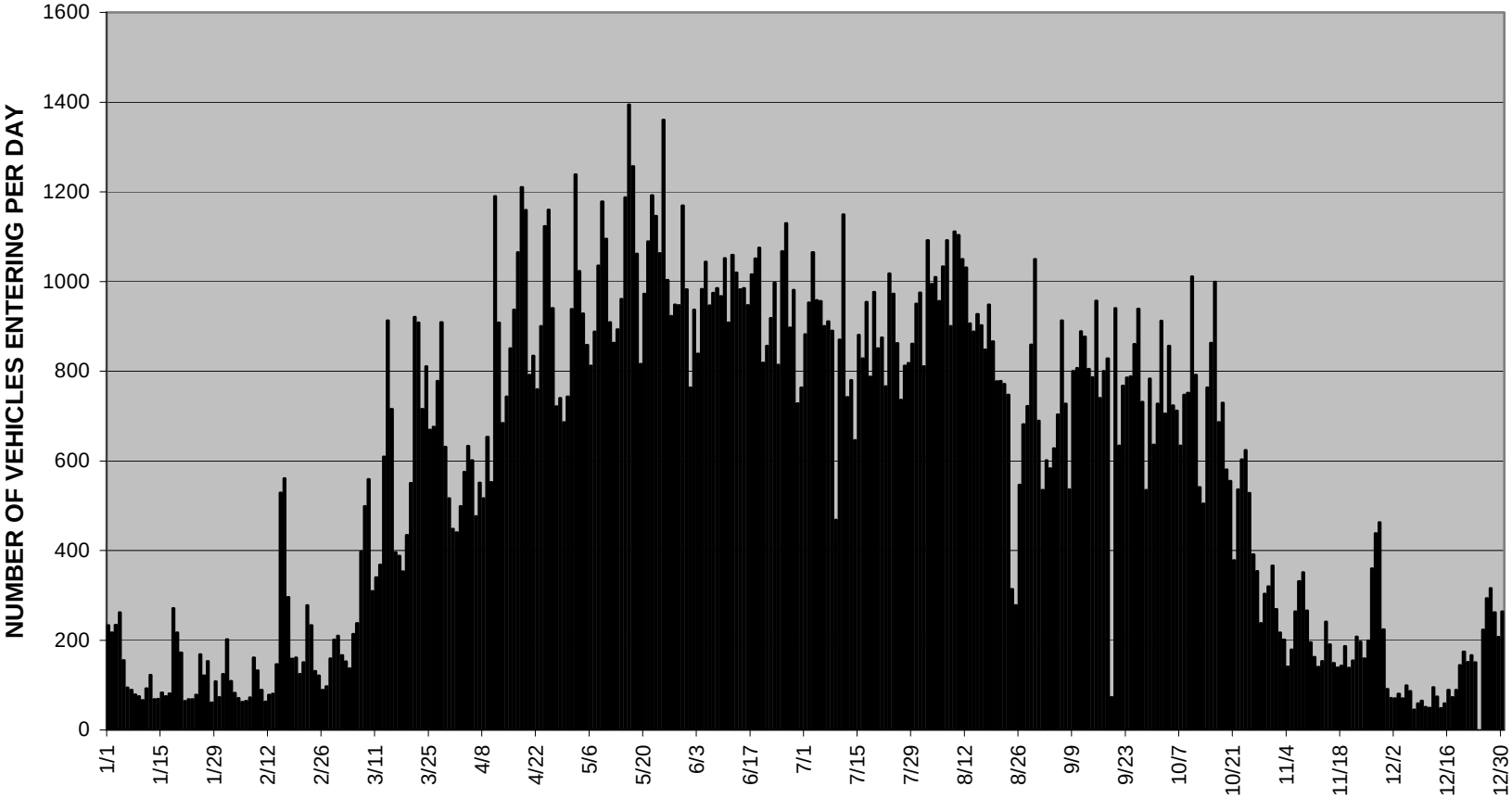


Figure 2 shows the *distribution* of the number of vehicles entering the Park by day. For example, there were 44 days on which 1000 or more vehicles entered the Park. Table 2 also summarizes the distribution.

FIGURE 2

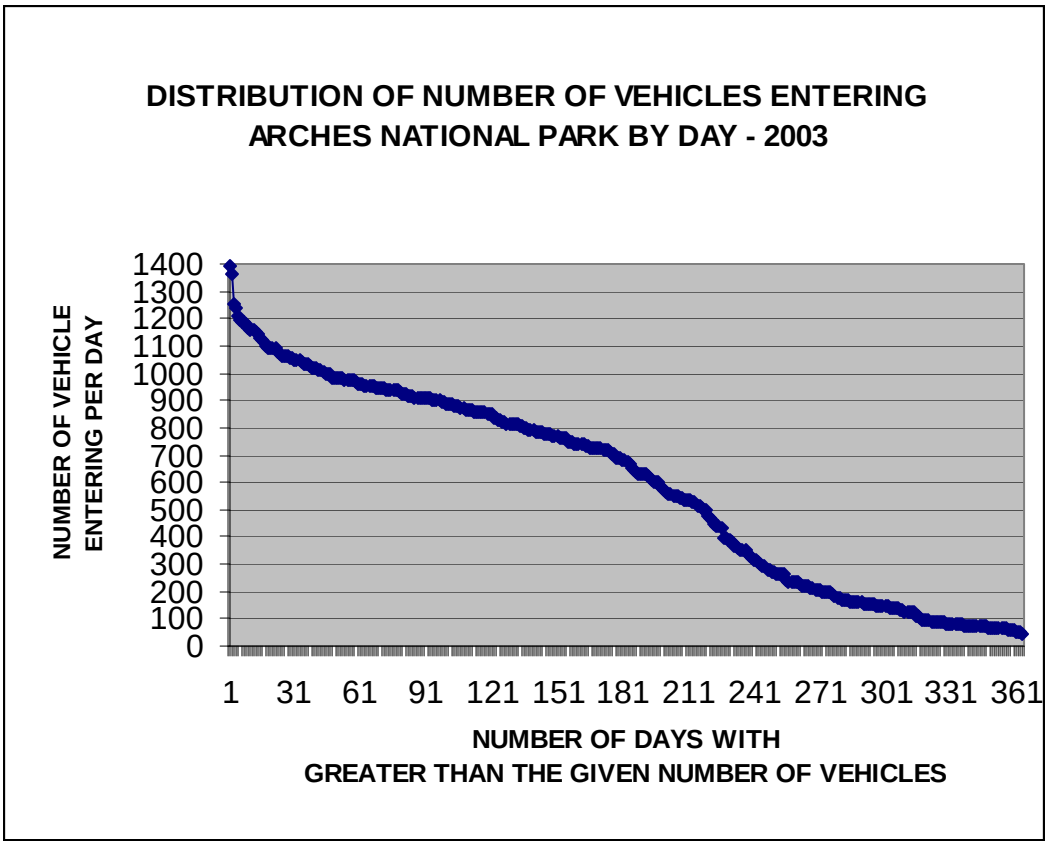


TABLE 2 - DISTRIBUTION OF ENTERING VEHICLES

Highest day -- 1394 entering vehicles	
Number of days with 1300 or more entering vehicles	2
Number of days with 1200 or more entering vehicles	5
Number of days with 1100 or more entering vehicles	18
Number of days with 1000 or more entering vehicles	44
Number of days with 900 or more entering vehicles	97
Number of days with 800 or more entering vehicles	137
Number of days with 700 or more entering vehicles	177
Number of days with 600 or more entering vehicles	197
Number of days with 500 or more entering vehicles	217
Number of days with 400 or more entering vehicles	226
Number of days with 300 or more entering vehicles	244
Number of days with 200 or more entering vehicles	273
Number of days with 100 or more entering vehicles	316

When the parking occupancy data for April 29 to May 3 and August 5 to 9 are compared with the number of vehicles entering the Park on those same days, some general conclusions can be made.

It appears that when the total number of vehicles entering the Park in a day exceeds about 900 vehicles there will be overcrowding in the Devils Garden, Windows / Double Arch and Wolfe Ranch / Delicate Arch Trailhead Parking Areas during at least some hours of the day. There were 97 days in 2003 when more than 900 vehicles entered the Park. Most of these 97 days occurred between mid-April and mid-October (see Figure 1).

These observations suggest that when visitation is higher - for example, when there are 1100 or more vehicles entering the Park - the parking problem will be severe. Eleven hundred vehicles per day represents 22 percent more vehicles than the level which triggers parking congestion at the three parking areas.

The general conclusion is that there is parking congestion in these three parking areas for about 100 days per year at the levels of visitation that existed in 2003. In 2003 the Total Recreation Visits to Arches was 755,987 [Source: Arches National Park website]. Any future growth in visitation will simply exacerbate the parking congestion.

With the assumption that daily visitation will grow in proportion to annual visitation growth, a 25 percent growth in visitation would translate to parking congestion at the Windows / Double Arch and Wolfe Ranch / Delicate Arch Trailhead Parking Areas for 170 days per year.

The above analysis focused on four parking areas because parking occupancy data was available for those four areas. Park staff state that there are many additional parking areas that experience parking congestion. While the other 16 parking areas likely have much shorter parking duration and higher parking turnover, many of those areas have a small number of spaces.

To put in perspective, a comparison can be made of the total number of parking spaces in the 20 parking areas (657 parking spaces) with the number of vehicles entering the Park daily. There are about 185 days per year when the number of vehicles entering the Park exceeds 657 and some days of the year when twice as many vehicles enter the Park as there are parking spaces.

Application of ITS Technology to Parking Areas

One strategy to address congested parking areas is to attempt to distribute visitors more widely in the Park. ITS technology can be used to monitor the number of occupied spaces in individual parking areas using vehicle detector technology. In turn, information on crowded parking areas could then be disseminated to Park visitors at the Park entrance station, the visitor center, and at roadside locations within the Park.

This portion of the report discusses the practicality and feasibility of this approach and potential barriers to its success.

A variety of technologies for vehicle detection exist, including inductive loop detectors, video detection, microwave, sonic, and others. In concept, detectors would count the number of vehicles entering a parking area and the number of vehicles exiting a parking area. An accompanying hardware and software system would maintain a count of the number of vehicles within the parking area so as to note when the parking area is approaching capacity or is at capacity.

Video detection, by the way, does not transmit a video image of the parking area to another location, such as the visitor center. Video detection simply utilizes changes in the video image, as a vehicle drives past a point on the roadway, to detect the arrival or departure of a vehicle. Video detection requires a video camera to be located at an elevated location with respect to the roadway. Most of the 20 parking areas do not have a suitable location for placement of a videocamera. Even if they did, the presence of a videocamera would be visually obtrusive in the Park environment.

Inductive loop detection is one of the most reliable and most extensively used detection technologies and would be a good candidate for parking area detection. Inductive loop detectors are buried in the pavement and are used on many Park roads for traffic counting purposes, thus they are a known technology to Park Service maintenance personnel. An inductive loop detector was observed on the eastbound Park roadway just west of the Delicate Arche Trailhead Parking Area.

To effectively use detection, the geometric configuration of the roadways entering and leaving the parking area must channel traffic over the detectors. Some of the Arches parking areas provide a good geometric configuration that allows for accurate counting of vehicles, while others do not. Those parking areas that are simply pulloffs along the roadway are virtually impossible to instrument. Parking areas like Devils Garden and The Windows / Double Arch that have a single lane approaching the parking area and a single lane departing the parking area are ideally suited to detectorization. Table 3 describes the suitability of several parking areas for detection. “Unsuitable” means that the geometry does not lend itself to detection.

TABLE 3 - PARKING LOT SUITABILITY FOR DETECTION

Visitor Center Parking Lot	
Park Avenue Viewpoint Parking Area	Unsuitable. Wide two-way driveways on either end.
La Sal Mountains Viewpoint Parking Area	Two-lane, two-way entrance road. A two foot wide raised median to separate inbound and outbound detectors would improve accuracy.
Courthouse Towers Viewpoint Parking Area	Unsuitable. Wide two-way driveways on either end.
Tower of Babel Parking Area	Unsuitable. Pulloff. Small size does not make this lot worthwhile for detection.
Unsigned Courthouse Wash Parking Area	Unsuitable. Pulloff. Small size does not make this lot worthwhile for detection.
Petrified Dunes Viewpoint Parking Area	Unsuitable. Pulloff. Small size does not make this lot worthwhile for detection.
Balanced Rock Parking Area	Good candidate. One lane channelized entrance and one lane channelized exit.
Garden of Eden Parking Area	Two-lane, two-way entrance road. A two foot wide raised median to separate inbound and outbound detectors would improve accuracy.
Windows Parking Area / Double Arch Parking Area	Excellent candidate. One lane entrance and one lane exit. A turnaround, to allow vehicles to recirculate through the parking area, is desirable.
Panorama Point Parking Area	Although this lot is a good candidate geometrically, it is unlikely that this lot experiences crowding. There is a large number of spaces and there is no attraction to cause long duration parking. Turnover will be high.
Wolfe Ranch / Delicate Arch Trailhead Parking Area	This location is complicated by two parking lots - a lot for passenger cars on the north side of the road and a lot for oversize vehicles on the south side of the road. The north side lot is one-way in and one-way out and could be instrumented if the entrance and exit were physically narrowed.
Delicate Arch Viewpoint Parking Area	Good candidate. Two-lane, two-way entrance road. A two foot wide raised median to separate inbound and outbound detectors would improve accuracy. This lot is large and the parking duration is probably short. This lot may not be subject to crowding.
Salt Valley Overlook Parking Area	Geometrically, this is a good candidate. However, the small size probably does not make this lot worthwhile for detection.
Fiery Furnace Viewpoint Parking Area	Geometrically, this is a good candidate. However, the small size may not make this lot worthwhile for detection.
Sand Dune Arch / Broken Arch Parking Area	Unsuitable. Pulloff.
Skyline Arch Trailhead Parking Area	Unsuitable. Pulloff.
Devils Garden Picnic Parking Area	The wide entrance and the wide exit would both need to be narrowed for detection. The small size probably does not make this lot worthwhile for detection.
Devils Garden Parking Area	Excellent candidate. Inbound detector can be placed just north of campground entrance. Outbound detector can be placed south of last parking space. The proposed turnaround, to allow vehicles to recirculate through the parking area, is a good idea.

Based on known levels of crowding, the size of parking areas, and the suitability of individual areas for detectorization, these are the recommended priorities for implementation.

First Priority
Windows / Double Arch Parking Areas (41 spaces)
Wolfe Ranch / Delicate Arch Trailhead Parking Area (66 spaces)
Devils Garden Parking Area (106 – 111 spaces)

Second Priority
Balanced Rock Parking Area (20 spaces)
Fiery Furnace Viewpoint Parking Area (17 spaces)

Third Priority
La Sal Mountains Viewpoint Parking Area (25 spaces)
Garden of Eden Parking Area (20 spaces)

Once information on parking area occupancy is collected, how will it be disseminated to visitors? Three suggestions are:

On small changeable message signs on the approach to the entrance station, perhaps at the pulloff located just north of the entrance road / U.S. Route 191 intersection.
On monitors in the visitor center
On changeable message signs at strategic locations on the Park roadway network

The changeable message signs that are envisioned would be much smaller than those used, for example, in highway construction zones. There are much smaller versions of changeable message signs available that would be much less visually obtrusive.

The following photograph is a changeable message sign installed in Great Smoky Mountains National Park.

Photo Credit: Frank Corrado, FHWA-EFLHD

The form and simplicity of the message on a changeable message sign (or a visitor center monitor) are important. A suggested message is:

PARKING
XX SPACES NOW OPEN AT DEVILS GARDEN
XX SPACES NOW OPEN AT THE WINDOWS
XX SPACES NOW OPEN AT DELICATE ARCH TRAIL

For this type of message, all of the words on the sign face would be permanent, as on a traditional traffic sign. Only the XX number display would change.

For the three First Priority parking areas, the following locations on the Park roadway network are recommended for changeable message signs.

Northbound, approaching Balanced Rock
Display information for all three parking areas

Northbound, approaching roadway intersection to Delicate Arch
Display information for Devils Garden and Delicate Arch Trail parking areas

Southbound, approaching roadway intersection to Delicate Arch
Display information for Delicate Arch Trail and The Windows parking areas

Southbound, approaching roadway intersection to The Windows
Display information for The Windows parking area

For the changeable message sign on the approach to the entrance station, a top line could be added that reads: **CONGESTED CONDITIONS EXPECTED TODAY**. This message would be illuminated on those days when it is expected that parking areas will be full, or near full, at some time during the day.

Two potential obstacles to implementation of detection systems and dissemination of that information are power supply and communications systems. There is no power supply within the Park, beyond the visitor center, with the exception of photovoltaic power at the Devils Garden campground. The power requirements for inductive loop detectors are modest and loop detectors have been powered by solar energy in remote locations for at least 20 years (including locations in the National Parks). Each loop detector requires only about two square feet of photovoltaic panel. Solar power can also be used for changeable message signs.

Communications may be a greater challenge. To disseminate information to the Park entrance station, the visitor center, and at roadside locations within the Park requires some form of communication. There are no wireline systems within the Park and radio and wireless systems are not 100 percent available due to topography. However, it may be possible to provide line of sight communication for a network connecting the three

First Priority parking areas and the four proposed locations for changeable message signs listed above.

In addition to the above, there are two other practical factors to consider. Both involve human behavior and decision-making in response to the parking information.

The first factor is the time lag between the receipt of parking information and arrival at the parking area location. This time lag would be greatest for someone driving from the park entrance / visitor center to Devils Garden. The distance is 18 miles and the driving time is likely at least 30 minutes. During that time, parking conditions may change. The parking area may fill during that interval or, if the area was full, spaces may open up by the time the visitor arrives at Devils Garden. The presence of additional information en-route (changeable message signs near Balanced Rock and the Delicate Arch Road) will help the visitor.

The second factor is how will visitors respond to the information. Some visitors – such as those who have driven 1500 miles to arrive at Arches – will be undeterred and will go to an attraction in spite of information about crowding. Others will modify their itinerary (both in time and space) within the Park. Still others will take advantage of touring less popular areas within the Park.

It is important to point out that it is <u>not</u> desirable to have all visitors who see the message divert to other locations within the Park. If that happened, the crowding would simply be moved to a different location. There is an analogy here to an accident blocking one lane on an urban freeway during the peak hour. If all motorists divert to the surface arterial streets, then the surface streets are chaos and no one is using the unblocked lanes on the freeway.

<u>Recommendation</u>

It is recommended that Arches National Park implement a system to monitor parking area occupancy at three major parking areas - Windows / Double Arch, Wolfe Ranch / Delicate Arch Trailhead, and Devils Garden – and that this information be disseminated to visitors at the entrance station, visitor center, and selected locations along Park roadways.

ITS APPLICATION AT PARK ENTRANCE STATION

Congestion at the Park entrance station has been a significant problem in recent years. The old entrance station was a single lane. During peak periods of visitation the queue of vehicles would back up onto U.S. Route 191, creating a hazard. Although the opening of a new two-lane entrance station (see photos) and the relocation and lengthening of the entrance road have alleviated the congestion and hazard, there may continue to be congestion and undesirable waiting times during periods of peak visitation. The peak day in 2003 saw 1394 vehicles enter the Park. This condition will grow as annual Park

visitation grows. In addition, a two lane entrance station requires two staff during those periods when demand is sufficient.

An automated system to process selected vehicles holds the promise of reducing congestion and waiting times, reducing personnel costs, and providing expedited entry for certain users. Automated lanes have been implemented at the Beaver Meadows entrance station in Rocky Mountain National Park (see photo), at Bryce Canyon National Park (funded by the NPS Alternative Transportation Program), and at Zion National Park.

Photo Credit: Roger Surdahl, FHWA-CFLHD

Processing of visitors in an automated lane can be accomplished by multiple technologies. One technology utilizes an electronic tag (also known as a transponder), similar to those used by toll roads for electronic toll collection. Because of the high cost of a transponder, this technology is not practical for the typical tourist visitor. It would, however, have application for repeat users such as Park Service vehicles, commercial vendors who provide services in the Park, transit or shuttle service, and others. The electronic tag technology is used at the Beaver Meadows entrance station in Rocky Mountain National Park for rangers, vendors, maintenance workers, and emergency equipment drivers.

A second technology would read an electronic strip such as exists on a National Parks Pass, Golden Age Passport, and Golden Access Passport. Swiping the Pass in a card reader would provide access to the Park. This type of system is also used a Beaver Meadows. The following photograph shows the cardswipe machine at Beaver Meadows.

Photo Credit: Roger Surdahl, FHWA-CFLHD

As originally conceived, both the National Park Pass and the Rocky Mountain National Park Pass (a pass good only at Rocky Mountain National Park) were intended to provide access through the Beaver Meadows entrance station. As actually implemented, Beaver Meadows is currently using only the Rocky Mountain National Park Pass. It would, however, be technologically possible to program the system to accept National Park Passes. Rocky Mountain National Park is considering a modification to their system that would allow Golden Age Passports and Golden Access Passports to be used.

The automated lane at Beaver Meadows was added as a fourth entrance lane at an existing three lane entrance. In summer, about one-fourth to one-third of all entrants use the automated lane. According to the Park's Fee Manager, the Park, in its improvement program, is planning to install automated entrance lanes at the Park's two other entrance stations. The cost of the automated lane (both the electronic tag system and the swipe card system) was about $80,000 to $90,000, plus the cost of constructing an additional lane.

For this form of automated system to be efficient, a lane must be dedicated solely to automated entry. For a two-lane entrance station, as exists at Arches, a significant proportion of vehicles entering the Park must be qualified to use automated entry. Otherwise, a disproportionate share of the traffic will use the staffed lane. So, a key question is, what proportion of Arches visitors could use automated entry?

As noted earlier in this report, the Park provided data on the number of vehicles passing through the entrance station on each day during the year. For calendar year 2003 the 30 days with the highest number of vehicles entering the Park per day included those days when 1052 or more vehicles entered the Park. Table 4 shows the proportion of entrants and their type of admission. The data in this table represent Park entrants who already possessed one of the named passes. In other words, they did not purchase the pass on the day of entry.

TABLE 4 - PROPORTION OF ENTRANTS BY TYPE OF ADMISSION

	National Park Pass		National Park Pass plus Golden Age plus Golden Access plus Golden Eagle	
	Average	Range	Average	Range
30 highest days of visitation (days with 1052 to 1394 vehicles entering)	31% *	23 - 45 % *	43% *	32 - 63 % *
Two sample days with ~ 800 vehicles entering		35%		46 - 55 %
Two sample days with ~ 600 vehicles entering		26 - 28 %		35 - 42 %
Two sample days with ~ 400 vehicles entering		25 - 32 %		33 - 53%
Two sample days with ~ 200 vehicles entering		27 - 36 %		35 - 48 %

* see text for exceptions to these ranges

For the 30 highest days of the year the National Park Pass fell below 23 percent of the entrants on only two days and averaged 31 percent. The days of the two exceptions were the Saturday and Sunday of Memorial Day weekend. On these days a large majority of Park entrants had not previously purchased a Park admission or a Park pass and thus made the purchase upon their arrival. The proportions of entrants who already possessed a National Park Pass on these two days were 3 percent and 7 percent.

For the 30 highest days the proportion of entrants who held one of the four types of passes (National Park Pass, Golden Age Passport, Golden Access Passport, or Golden Eagle) fell below 32 percent only on the two Memorial Day weekend days. On those days the proportions who already possessed one of the four types of passes were 11 percent and 13 percent.

Recognizing that the days of highest visitation might represent a different set of demographics than off-peak visitors, additional days were sampled. As also shown in Table 4, the proportion of entrants using various forms of passes was within the same ranges on days with 200, 400, 600, or 800 vehicles entering the Park.

Thus, typically, about one-fourth to one-third of entrants use a National Park Pass that they already possess. And, when the other three types of passes are also considered, about one-third to one-half of entrants hold one of the four passes.

Based on these proportions, it would not make sense to take one of the two existing lanes and dedicate it to automated entry. If, however, a third lane were added to serve as an automated lane, it could effectively process a significant proportion of entrants to the Park.

Appropriate signing on the approach to the entrance station would be needed to direct vehicles to the appropriate lane. A suggested message would be:

PARK PASS, GOLDEN AGE, GOLDEN ACCESS,
AND GOLDEN EAGLE HOLDERS
USE RIGHT LANE FOR EXPEDITED ENTRY

ALL OTHERS USE TWO LEFT LANES

Upon implementation and widespread use of the proposed America the Beautiful Pass (see below), the message would be simplified.

For this system to work well, not only would a third entrance lane need to be added, but a multiple lane approach to the entrance station should be lengthened. If the multiple lane approach is not lengthened, then Park Pass holders, etc. might not be able to bypass the queue of vehicles waiting for the non-automated lanes.

There are additional issues associated with an automated card swipe system. Golden Age Passports and Golden Access Passports have no expiration date. Thus, use of an expired card is not an issue. National Park Passes do expire – based on a date punched in the card – but there is currently no expiration date magnetically encoded on the card [National Park Passes previously did have a magnetically encoded expiration date]. As a result, an expired card could continue to be used for Park entry.

Congress has recently passed legislation to create a new America the Beautiful Pass. In concept, the multiple forms of Passes and Passports that currently exist would be replaced by a single card that would be available to the different categories of users at different prices. If the America the Beautiful Pass includes a magnetically encoded expiration date, the issue of expiration date would be solved.

A second issue is fraudulent use of a card by other than the original cardholder. When a Pass is presented to a Park Ranger at an entrance station, the Ranger can ask for identification to confirm proper use and limit fraud. This confirmation would not be possible with an automated system.

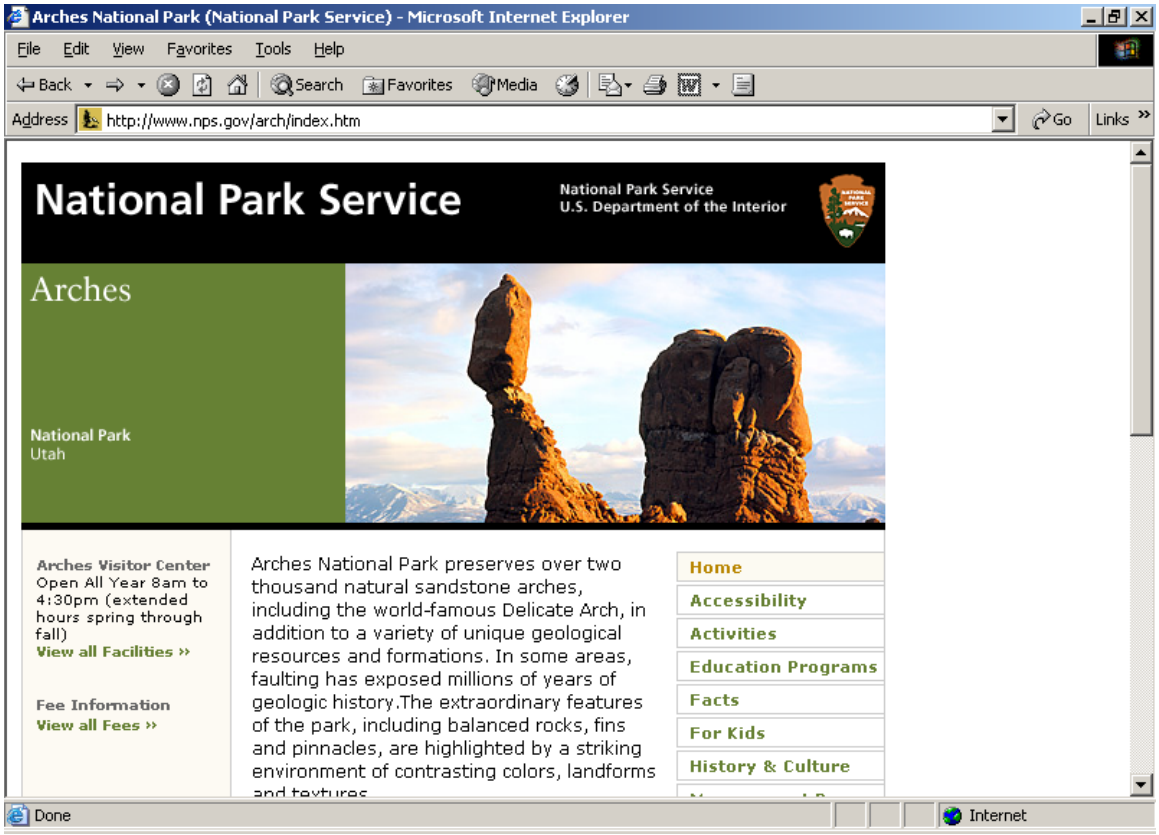
Recommendation

There are clearly advantages and disadvantages to an automated system. It is recommended that Arches National Park collect data on waiting times and queue lengths during busier days of the year to determine the magnitude of the entrance station delay problem. The Park should also continue to collect data and make observations as Park visitation grows in future years.

If delays are significant and unacceptable for a large number of hours during the year, it is recommended that Arches National Park consider the advantages and disadvantages of such an automated system. Conditions may change, such as the inclusion of magnetically encoded expiration dates on Park passes, that would make an automated system more attractive. If Arches chooses to implement an automated system of entry, it should be an additional (third) lane with adequate approach lanes to bypass queues for the non-automated lanes.

ITS APPLICATION FOR TRAVELER INFORMATION

Advanced Traveler Information Systems provide an opportunity for Park visitors to better plan their trips to Arches. A summer, 2003 Visitor Study found that 31 percent of Park visitors obtained information from either the National Park Service website or the Arches National Park website (see screenshot below) prior to their visit. The survey also found that 16 percent of visitors obtained information on Arches from other Internet websites. The Internet, and other forms of ITS technology, have the potential to provide a wealth of information to travelers that will assist them in trip planning.



The Internet can be used as a tool:

- to provide information about Arches National Park on the Arches website,
- to provide links from the Arches website to other websites of related interest, and
- to direct users from other websites to the Arches National Park website.

Provide Information on Arches Website

The Arches National Park website is comprehensive and provides a variety of information. The website can be enhanced to help solve some of the transportation issues at Arches.

Because visitor congestion, crowded parking lots, and visitor distribution are major issues at Arches, the Arches website can be used as a tool to advise visitors about these conditions and help them plan their visit. Advance knowledge of crowded conditions may influence future visitors in terms of the season, week of the year, day of the week, or time of day that they visit Arches.

The **Plan Your Visit** page of the Arches website could include information such as the following.

> Arches National Park is a popular destination from mid-April through mid-October. Many days during these months experience crowding and an insufficient supply of parking at many of the destinations within the Park. Weekends and holidays have the highest visitation during these months. Visitors who tour Arches on weekdays and during the early morning and late afternoon and evening hours will more easily find parking and experience less crowding on trails.

The **Camping** page of the Arches website describes the reservation system for individual sites. It is suggested that the following information be added to the description.

> The campground usually fills every night from mid-March through mid-October. In the spring any first-come, first-served sites are often filled by 8:00 a.m. On hot summer days the first-come, first-served campsites may not fill until after 12:00 noon. The Park entrance station or visitor center can advise you whether space is available upon your arrival at the Park.

Provide Links to Other Websites

The Arches National Park website provides links to the following:

> Bureau of Land Management (Moab area)
> Canyonlands Natural History Association
> Grand County Travel Council (a link to discovermoab.com)
> Utah Travel Council (a link to utah.com)

In addition to the above, it is suggested that links be included to other nearby National Park Service units such as Canyonlands National Park, Natural Bridges National Monument, Hovenweep National Monument, Colorado National Monument, Mesa Verde National Park, and Capitol Reef National Park. The Mesa Verde National Park website, for example, lists nearby National Park Service units on its **Nearby Attractions** page. Including these links could be done as a reciprocal agreement with other Park units under which those units would include links to the Arches National Park website on their webpages.

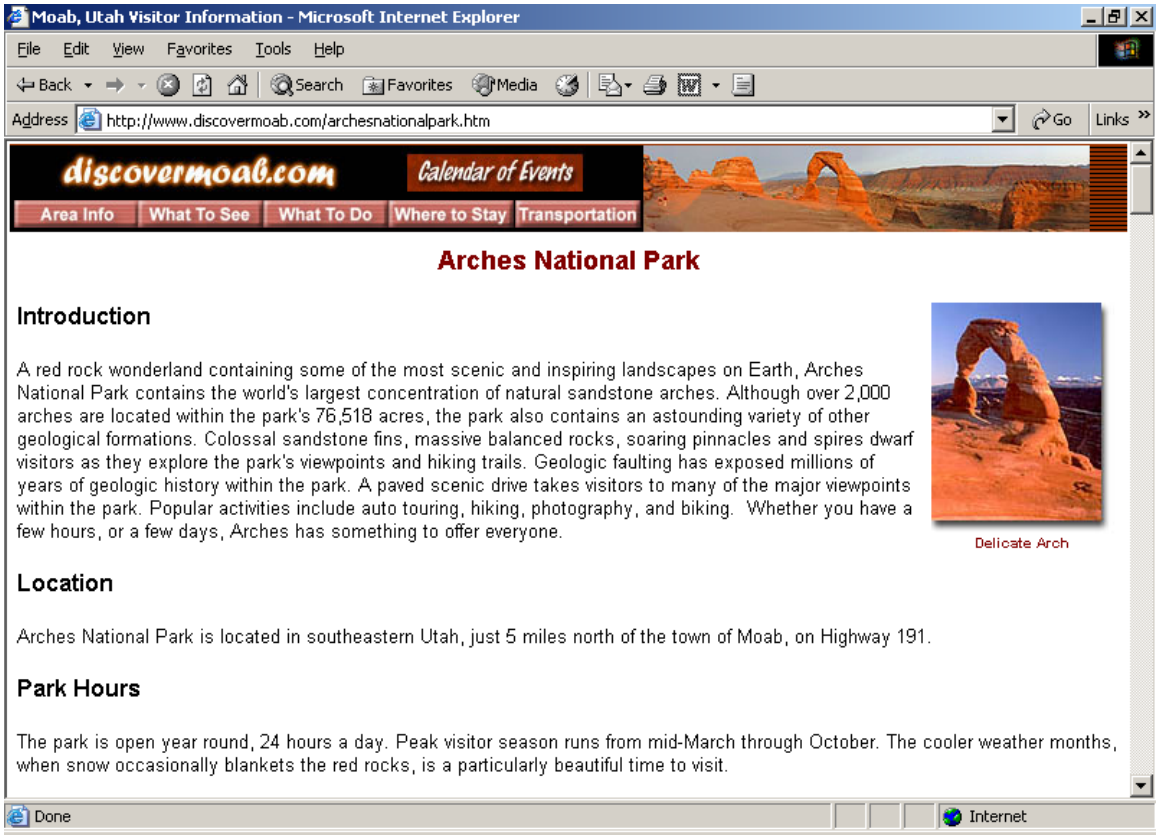
Links to the Arches National Park Website

Other related websites do a good job of providing information about Arches National Park. The Utah Travel Council home page (www.utah.com), for example, includes a link to its National Parks page (www.utah.com/nationalparks/) which, in turn, includes a link to a page about Arches National Park (http://techmarketing.org?Utah/main.aspx?exp=22&user=-1&target=Arches) (see three following screen shots). None of these three pages, however, provides a link to the Arches National Park website home page, where the user could find more extensive information on the Park. It is suggested that Arches National Park request that such a link be established. Given that the Arches website provides a link to www.utah.com, this request could be made as a request for reciprocity.


Utah National Parks - Zion National Park, Bryce Canyon, Arches National Park, Canyonlands Natio - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://www.utah.com/nationalparks/
Go Links
Utah! Travel & Adventure
utah.com
Official State Tourism Site
Place to see
Outdoor Recreation
Things to do
Visitor Center
Groups
Real Estate
Travel Store
Trips & Travel Planning
UtahRocks™
WWW.UTAH.COM
Arches National Park
National Parks
Arches
Bryce Canyon
Canyonlands
Capitol Reef
Zion
Grand Canyon
Bus Tours
Vacation Services
Lodging
Guides/Rentals
Hot Deals
Campgrounds
Events
Maps
Weather
Transportation
Utah National Parks overview
With five national parks, Utah is America's national parks capital! The national parks include: Zion National Park, Bryce Canyon, Arches National Park, Canyonlands National Park, and Capitol Reef National Park.
PHOTO TOUR
We also claim the North Rim of Grand Canyon National Park, since it is best accessed through southern Utah. Each of these parks offer unique beauty and recreational opportunities.
Utah.com Presents:
DUC
Sorrel River Ranch
Great National Park Resort!
BIKE RAFT HOLIDAY EXPEDITIONS
The best way to see parks!
MOAB
UTAH'S ADVENTURE CAPITAL
http://www.utah.com/nationalparks/arches.htm
Internet


Arches National Park | Utah.com - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://techmarketing.org/Utah/main.aspx?exp=22&user=-1&target=Arches
Go Links
Utah! Travel & Adventure
utah.com
Official State Tourism Site
Place to see
Outdoor Recreation
Things to do
Visitor Center
Groups
Real Estate
Travel Store
RED CLIFFS LODGE
Arches National Park
National Parks
Arches
Bryce Canyon
Canyonlands
Capitol Reef
Zion
Grand Canyon
Bus Tours
Vacation Services
Lodging
Guides/Rentals
Hot Deals
Campgrounds
Events
Maps
Weather
Transportation
Arches National Park
Arches National Park contains the world's largest concentration of natural stone arches. This National Park is a red, arid desert, punctuated with oddly eroded sandstone forms such as fins, pinnacles, spires, balanced rocks, and arches. The 73,000-acre region has over 2,000 of these "miracles of nature." A 40-mile round-trip paved road in arches national park leads visitors to the major sights, including Balanced Rock, Skyline Arch, Double Arch, Fiery Furnace, and the park's most famous geologic feature
PHOTO TOUR
Utah.com Presents:
Aarchway Inn
MOAB
Closest Lodging to Arches
Sunflower Hill
A Luxury Inn
"Location - Location"
APACHE MOTEL
Internet

The discovermoab.com website provides a link to information on Arches National Park (www.discovermoab.com/archesnationalpark.htm) (see the two following screenshots). This latter website provides extensive information about Arches and does provide a link to the Arches National Park website



Addition of the linkages suggested above will lead to greater percentages of visitors accessing the Arches National Park website when planning their visits and will provide the opportunity to circulate a greater amount of information about the Park to these future visitors.

Highway Advisory Radio

Arches National Park currently broadcasts traveler information via a Highway Advisory Radio (HAR) system. The message provides a succinct, yet comprehensive, set of information about visiting the Park.

Crowding, especially the shortage of parking, is such a significant issue that it deserves mention on the HAR broadcast. A message, using language similar to that suggested above for the Arches website could be included on HAR during selected months of the year.

> Arches National Park is a popular destination from mid-April through mid-October. Many days during these months experience crowding and an insufficient supply of parking at many of the destinations within the Park. Weekends and holidays have the highest visitation during these months. Visitors who tour Arches on weekdays and during the early morning and late afternoon

and evening hours will more easily find parking and experience less crowding on trails.

If a parking management system is implemented, the message could also advise Park visitors to check the changeable message signs on the approach to the entrance station, and information at the visitor center, about parking conditions.

Other Media for Traveler Information

The state of Utah was an early adopter of the 511 traveler information system. This system allows the telephone user to simply dial 511 to obtain traveler information. Arches National Park should work with the Utah Department of Transportation to become included in the 511 system.

A cable television visitor channel serves Moab hotels with information about a variety of destinations and activities, including Arches National Park. The 2003 Arches National Park Visitor Study found that less than one percent of visitors obtained information about the Park through this source. Despite the small audience, the programming content could include information to alert visitors to possible crowding during certain seasons of the year. It could also encourage visitors to visit the Park early or late in the day, when there is less crowding.

CLOSING

ITS technology offers many opportunities to address transportation issues and traveler needs in Arches National Park. In most instances ITS solutions can be implemented at a lower cost than solutions that are more infrastructure intensive. The use of technology to relieve crowding, better distribute visitors, and reduce waiting times at the Park entrance will improve the visitor experience. Traveler information systems will support pre-planning of visits to the Park.

Arches National Park should pursue the ITS solutions described in this report.